

REMARKS

Claims 1-7 have been canceled. Claim 9 has been amended. New claims 19 and 20 have been added. Thus, claims 9-20 are presented for examination. Support for the amendment to claim 9 may be found in the specification at pages 24-25 (paragraph [0053]). Thus, no new matter has been added. Reconsideration and withdrawal of the present rejections in view of the amendments and comments presented herein are respectfully requested.

Rejections under 35 U.S.C. §103(a)

Claims 9-12

Claims 1-7 and 9-12 were rejected under 35 U.S.C. §103(a) as being unpatentable over Uetani et al. (US 2001/0014428) in view of Hatakeyama et al. (US 2002/0207201). Claims 1-7 have been canceled herein, thus rendering the rejection moot as it applies to these claims. Thus, the rejection will be addressed as it relates to claims 9-12. As explained below, the cited combination of references does not render the presently claimed invention obvious.

The present invention relates to a resist composition that exhibits a high level of resolution, minimal line edge roughness (LER), and a broad depth of focus, as well as a method for forming a resist pattern that uses such a resist composition. Present claim 9 recites "an acid generator component (B) that generates acid on exposure, wherein . . . component (B) comprises a sulfonium compound represented by a general formula (b-1)." Uetani et al does not disclose the sulfonium compound represented by a general formula (b-1).

In addition, although Uetani et al discloses a copolymer of 2-methyl-2-adamantylmethacrylate/3,5-dihydroxy-1-adamantylmethacrylate/ α -methacryloyloxy- γ -butyrolactone, this copolymer is not the same as claimed resin component (A) that undergoes a change in alkali solubility in the presence of acid. The recited component (A) has the following features:

- (1) said resin component (A) has a weight average molecular weight of no more than 7500 and comprises structural units (a) derived from a (meth)acrylate ester, wherein said structural units (a) comprise
- (2) structural units (a1) derived from a (meth)acrylate ester containing an acid dissociable, dissolution inhibiting group,

- (3) structural units (a2) derived from a (meth)acrylate ester comprising a lactone-containing monocyclic group, and
- (4) structural units (a3) derived from a (meth)acrylate ester comprising a hydroxyl group-containing aliphatic hydrocarbon group

The copolymer of Uetani et al. does not possess the above features (1) to (4). Since the structural unit comprising a lactone-containing monocyclic group is used as the structural unit (a2) in Claim 9, the monomer unit comprising γ -butyrolactone of Uetani et al is different from the structural unit (a2) of Claim 9. In addition, since the number of hydroxyl group of the structural units (a3) of Claim 9 is one, dihydroxy-1-adamantyl (meth)acrylate disclosed in Uetani et al. is not the same as the structural units (a3) of Claim 9. Thus, the resin components disclosed in Uetani et al are clearly different from those recited in Claim 9. These resin components are also not disclosed or suggested by Hatakeyama et al. Thus, even if the acid generators disclosed in Hatakeyama et al are combined with the resist composition of Uetani et al, the method recited in present claim 9 would not be obtained. Thus, the claims cannot be *prima facie* obvious.

Moreover, even if the claims were *prima facie* obvious in view of these references, the claimed invention provides unexpected results that would effectively rebut any such allegation. The anion (acid) portions of onium salts that are conventionally used as acid generators are almost all chain-like fluorinated alkylsulfonate ions containing a large number of carbon atoms to enable favorable control of the diffusion length of the acid within the resist film. However, these fluorinated alkylsulfonic acids have safety concerns, and the use of such compounds is now being restricted on a worldwide basis (specification at page 2, lines 11-21).

The specific sulfonium compound shown in the formula (b-1), having the cyclic structure in the anion portion as the acid generator, provides a short diffusion length within the resist film without using the above-referenced types of long-chain fluorinated alkylsulfonic acids (specification at page 3, paragraph 4). Compared to Example 9 of the present specification which uses PAG 3 having a chain-like structure in the anion portion as the acid generator (Table 1), Example 1 uses the sulfonium compound represented by the general formula (b-1) (PAG1) having the cyclic structure in the anion portion as the acid generator (Table 1). As illustrated in

Table 2, Example 1 resulted in a broader depth of focus (Example 1: 450 nm; Example 9: 400 nm).

Claim 9 as amended further recites that X in the formula (b-1) is “a perfluoroalkylene group of 3 carbon atoms.” Because of this, the acid becomes stronger, and the transparency relative to high energy light beams of 200 nm or less or electron beams also improves favorably (Specification at page 24, line 19, and page 25, lines 1-4).

Claim 9 combines a specific resin which includes the above features (1) to (4), with the above-referenced acid generator (B). By using a combination of a resin with a weight average molecular weight of no more than 7,500 containing the structural units (a), an adequate transparency for use within a resist used in a process that employs a wavelength of 200 nm or less such as an ArF excimer laser is obtained. Furthermore, a resist pattern can be formed that exhibits excellent resolution and pattern shape as well as reduced levels of LER and defects. In addition, the depth of focus (DOF) during formation of the resist pattern is large, and the shape of the obtained resist pattern is favorable (specification, page 7, paragraph [0013]). In addition, the resin containing the structural units (a1), the structural units (a2) and the structural units (a3) is most preferable (specification at page 15, paragraph [0042]).

Moreover, as compared to Example 8 of the present application which uses a γ -butyrolactone methacrylate as the structural unit (a2), in Example 4 of the present application which uses the structural units (a2) derived from a (meth)acrylate ester comprising a lactone-containing monocyclic group, the resist pattern shape becomes extremely vertical. In addition, as described above, since Uetani et al uses the monomer unit comprising γ -butyrolactone, the same excellent resist pattern shape as Claim 9 cannot be obtained.

Such unexpected results could not have been predicted based on the teachings of these references, and would effectively rebut any allegation of *prima facie* obviousness. Thus, claims 9, as well as claims 10-12 and 19, which depend either directly or indirectly from claim 9, are nonobvious over the cited references.

Claims 13-18

Claims 13-18 were rejected under 35 U.S.C. §103(a) as being unpatentable over Uetani et al. (US 2001/0014428) in view of Hatakeyama et al. (US 2002/0207201) and in further view of Uetani et al. (US 6,348,297).

Claim 13 recites a resist composition, comprising a resin component (A) which has a weight average molecular weight of no more than 8,000, and an acid generator component (B), wherein:

- (1) said component (B) comprises at least one sulfonium compound represented by a general formula (b-1) or a general formula (b-2), and
- (2) an onium salt-based acid generator comprising a straight-chain fluorinated alkylsulfonate anion of 1 to 7 carbon atoms, and
- (3) the blend ratio (weight ratio) between the onium salt-based acid generator and the one or more compounds selected from the sulfonium compounds is within a range from 1:9 to 9:1.

As described below, the combination of references cited by the Examiner fails to suggest the invention as recited above.

Uetani et al. (US 2001/0014428) is described above. Uetani et al (6,348,297) discloses a chemical amplification type positive resist composition that produces a good pattern profile on any kind of substrate, including basic and low reflectance substrates. In order to achieve this, Uetani et al. uses an aliphatic sulfonium salt represented by the formula (I) (Column 2, lines 51-60). In particular, in the aliphatic sulfonium salt represented by the formula (I), each group in the sulfonium-cation is a nonaromatic group. In addition, in Uetani et al., since sufficient effects are not obtained when the number of carbon atoms in a portion of anion of an aliphatic sulfonium salt represented by the formula (I) is small, the aliphatic sulfonium salt represented by the formula (I) is used together with an onium salt selected from compounds of the formulae (IIa). Uetani et al. also describes the blend ratio in this case (Column 4, lines 49-65).

The acid generators disclosed by Hatakeyama et al., which the Examiner alleges correspond to the compound represented by the general formula (b-1) or (b-2) of the present claims (Hatakeyama et al: PAG-1, and paragraph 30), contain a triarylsulfonium cation. Since the sulfonium compounds of Hatakeyama et al. have aryl groups in their cation portion, these compounds are positively eliminated from the aliphatic sulfonium salt represented by the formula (I) of Uetani et al. Therefore, even if the compound containing a fluorinated alkylsulfonate is blended with the acid generators of Hatakeyama et al, this combination would be clearly different

from the combination of the compound represented by the formula (I) and compounds of the formulae (IIa) of Uetani et al (US Patent 6,348,297). Therefore, the blend ratio of Uetani et al (US Patent 6,348,297) cannot be used as the blend ratio of the acid generators of Hatakeyama et al. As such, the combination of references cited by the Examiner would not suggest the invention of Claim 13.

In addition, even if the claims were *prima facie* obvious in view of these references, the claimed invention provides unexpected results that would effectively rebut any such allegation. As clearly shown in Examples 3 to 7 of the present application, the inclusion of components (1)-(3) results in a resin having superior levels of LER and developing defects (specification at page 28, lines 14-19). It is clearly shown in Examples 3 to 7 of the present application. Namely, by mixing the sulfonium compounds represented by the general formula (b-1) and the onium salt-based acid generator (2) in the above blend ratio (weight ratio) (3), the pattern shape and the LER were particularly superior (specification at page 46, line 7 to page 47, line 2).

Such unexpected results could not have been predicted based on the teachings of Maeda, and would effectively rebut any allegation of *prima facie* obviousness.

Thus, claims 13, and claims 14-18 and 20, which depend either directly or indirectly from claim 13, are nonobvious over the cited combination of references

CONCLUSION

Applicants submit that all claims are in condition for allowance. Should there be any questions concerning this application, the Examiner is respectfully invited to contact the undersigned at the telephone number appearing below.

Respectfully submitted,

KNOBBE, MARTENS, OLSON & BEAR, LLP

Dated: 8/27/08

By: 

Neil S. Bartfeld, Ph.D.
Registration No. 39,901
Agent of Record
Customer No. 20,995
(619) 235-8550